trends in higher education

MDPI

Article

An Extended Technology Adoption Model with Perceived Visual Attractiveness to Assess Academic Web Portals

Jose Maria S. Garcia II [1], Melanie M. Himang [1], Celbert M. Himang [2], Gerry Ritz R. Densing [1], Marie Joy B. Alit [1], Noel P. Burgos [1], Miriam F. Bongo [3,*] and Lanndon A. Ocampo [2]

[1] College of Computer, Information and Communications Technology-Main Campus, Cebu Technological University, Cebu 6000, Philippines
[2] Graduate School-Main Campus, Cebu Technological University, Cebu 6000, Philippines
[3] Gokongwei College of Engineering, De La Salle University, Malate, Manila 1004, Philippines
* Correspondence: miriam.bongo@dlsu.edu.ph

Abstract: The educational system in the Philippines has been slowly progressing in terms of its technological infrastructures, such as web portals. Such a pattern in web portal development prompts stakeholders to carefully consider the adoption constructs, in order for limited and scarce resources to be wisely allocated. Therefore, this paper intends to assess an academic web portal by extending the classical technology acceptance model (TAM) framework with the addition of perceived visual attractiveness. A case study in a state university in Cebu, Philippines, in which 418 undergraduate students participated, was performed to explore relationships among constructs. Using structural equation modeling, the results indicated that perceived attractiveness poses a significant influence on perceived ease of use and perceived usefulness, which thereby significantly impacts perceived attitude and behavioral intention. Such results can aid stakeholders in managing resources in the development of academic web portals by focusing on important constructs such as perceived visual attractiveness.

Keywords: academic web portal; perceived visual attractiveness; technology adoption; technology acceptance model

Citation: Garcia II, J.M.S.; Himang, M.M.; Himang, C.M.; Densing, G.R.R.; Alit, M.J.B.; Burgos, N.P.; Bongo, M.F.; Ocampo, L.A. An Extended Technology Adoption Model with Perceived Visual Attractiveness to Assess Academic Web Portals. *Trends High. Educ.* **2023**, *2*, 152–167. https://doi.org/10.3390/higheredu2010010

Academic Editor: Janika Leoste

Received: 4 January 2023
Revised: 20 February 2023
Accepted: 23 February 2023
Published: 27 February 2023

1. Introduction

In the fast-paced way of human operations dominated by convenience in the exchange of information among entities, web portals have become one of the most useful support platforms to provide access to integrated information and services from diverse sources in a single web-based version [1]. The use of web portals further paved the way for user engagement that is personal and experience-based. With the development of the Internet came the growth of web-based portals, which prompted an elevation of Internet-ready devices used to access web portals [2]. In fact, web portals of various purposes abound across a number of domains. For instance, web portals are designed according to their purposes, such as the following: (a) patient portals as a common technological feature of healthcare which focus on the provision of real-time access to information about patients, thus, enhancing patient–clinician communication [3]; (b) employee portals as a browser-based user interface, which aim to provide access to personalized information as well as resources and applications [4]; (c) government portals as an open data initiative to enable transparency, efficiency, and public participation in various public management policies [5]; (d) enterprise portals as a medium allowing employees, suppliers, and partners to obtain required information quickly and easily in a repository that is organized with centralization concepts [6]; and (e) library web portals as an electronic resource mode made available through information gateways to access digital content and library services [7], among others.

While web portals are designed to be interactive and immersive to multiple types of users, it is imperative to carefully explore their interfaces, and to make certain that they

appeal to users effectively. Otherwise, a web portal that is difficult to use and interact with leaves a poor image on the Internet, and weakens the position of any organization [8]. In recognition of such a challenge, research in the literature tends to focus more on the in-depth analyses of web portals' adoption, uniqueness, and challenges relating to quality. Some of these studies include concepts on the influence of faculty-related and web portal design-related factors on portal usability [9]; the factors behind the reduced adoption rate of portals among underserved patients [10]; the effectiveness of a web portal for building a control sector based on its content, design, and functionality [11]; the adoption mechanisms of a supplier portal under three specific levels (i.e., enterprise, supply chain, and industry) to aid in the decision-making process among stakeholders [12]; and the influencing factors for the use of portals according to three complementary measures in the frequency of use, length of visits, and repeat use [13], to name a few.

Looking into the directions in which previous research concentrated, the analysis of the usability, effectiveness, and other influencing factors with regard to the implementation of web portals can form part of the more concise body of analyses that aim to assess the applicability of new technology. In the literature, there has been a plethora of technology acceptance models, such as the technology acceptance model (TAM) [14]; unified theory of acceptance and use of technology (UTAUT) [15]; Technological, Pedagogical, and Content Knowledge (TPACK) [16]; uses and gratification model (U&GT) [17,18]; and value-based adoption model (VAM) [19], among others. All of these models have, in one way or another, paved the way for a deeper understanding of technology adoption principles across various disciplines due to their inherent strengths. For one, the TAM prides itself in the prime discovery of three factors that were deemed sufficient in explaining, predicting, and presumably controlling the acceptance of technology [20]. In fact, according to the Theory of Reasoned Action, which is the main benchmark of TAM, when such factors that influence the intentions of users in technology use are known, acceptance and eventual increase in technology use can be promoted. For another, the UTAUT is directed towards the analysis of eight competing models that explain the acceptance and intention of technology use. Furthermore, according to [15], the factors underlined in the UTAUT play a prominent role in determining user acceptance and usage behavior. Then, TPACK focuses on two poles: one, in describing the factors that influence successful teaching with the use of technology, and another, in supporting and promoting understanding of the integration of technology in education from the perspective of theory, pedagogy, and methodology. On the other hand, the U&GT explains motivation in overall media use, including traditional media, the Internet, and SNSs, among others. Here, the guiding principle based on assumptions that touch on the direction of media as well as the role of audiences were highlighted. Lastly, the VAM takes advantage of the synergy of the TAM and the perceived value of [21] to better understand the adoption behavior of users. It prides itself on its realistic side, which includes the input components in technology adoption.

Among the previously developed models of technology acceptance, the TAM has been one of the most influential models, and received substantial empirical support from succeeding research studies that applied such a model [22]. Over the years, despite the wide applicability of the TAM in technology adoption, considerable limitations of the original framework have been apparent, which paved way to several recent extensions of the TAM to integrate one or a combination of the following constructs, depending on their applicability: acceptance, medical service quality perception [23], attitude towards route diversion, quality features (i.e., content quality, content design quality, interactivity, functionality, user-interface design, accessibility, personalization, responsiveness, information) [24], brand equity [25], descriptive norms and environmental beliefs, government regulations, injunctive norms, personal norms [26], expectations, outcome satisfaction, process satisfaction, usefulness [27], facilitating conditions, privacy, resistance to technology, technological anxiety [28], familiarity with the network [24], habit [29], heath valuation [30], human-to-human interaction and human-to-information interaction, trust, willingness to exchange information [31], perceived visual attractiveness [32], perceived enjoyment [33], perceived

information [34], security [35], and social influence [36]. Among these factors, one of the most prominent integrations of the traditional TAM factors is that of perceived visual attractiveness. In the greater umbrella of consumer marketing literature, *ceteris paribus* contends that the more attractive products become, the more favorable attitudes are developed toward its purchase compared to its unattractive counterparts [37]. In fact, it is theorized that the form and visual appeal of a product drive both the responses of users in cognitive and affective psychological scope, which in turn dictates behavioral desires. Scoping into the take of perceived visual attractiveness into the more specific context of website design, visual elements including colors and layout can impact the use of websites through other linking elements in usefulness, enjoyment, and ease of use [32,38]. Additionally, the perceived visual attractiveness of technology prompts the learning process, as expounded under the cognitive load theory [39]. Considerably, learning is promoted when the learning task does not require too much cognitive capacity due to its presentation, not to mention its aesthetics or perceived visual attractiveness. Therefore, in the context of educational research where the cognitive workload is a core concept, it is worthwhile to investigate the acceptance of technology along the lines of perceived visual attractiveness, aside from the traditional set of elements influencing user behavior. Refer to Section 2. for more details about perceived visual attractiveness.

Research Gap Analysis

With respect to the application of the TAM and its extended constructs in the web portal domain, university-based web portals remain underdeveloped in the literature despite the need to critically evaluate the adoption and acceptance of portals in an academic context. In fact, only a few research studies explored how academic web portals are perceived by their users [40]. However, none of these studies embedded the construct of perceived visual attractiveness, as it is also used in other technology adoption models in various contexts. This is despite the influence of such constructs in other contexts including feelings of usefulness, enjoyment, and ease of use [31]. Therefore, this study sought to assess the use of an academic web portal with respect to the extended TAM framework, incorporating the aspect of perceived visual attractiveness. While this research is not the first to integrate the construct of perceived visual attractiveness into the basic TAM framework in the general context of web portals [31], this study wished to make the following contributions to the body of literature. First, this study specifically applies the extended TAM framework to an academic web portal, which in contrast to a typical web portal is expected to perform dedicated tasks and services for a predefined set of users (e.g., students, faculty members) on a regular basis. Key results obtained from prior empirical research in the literature involving other forms of web portals cannot be completely generalized and reflected in an academic web portal, as the former's users are only expected to access a web portal intermittently or as the need arises. Second, perceived visual attractiveness, as a new construct, is integrated into the basic TAM framework to capture how this construct influences perceived usefulness and perceived ease of use. A case study was performed in a state university in Cebu, Philippines, to demonstrate the applicability and validity of the proposed framework.

The rest of the study is organized as follows: In Section 2, the theoretical background of the proposed extended TAM framework is discussed in detail. In Section 3, the research design is presented along with the research subjects, instruments, and procedure. In Section 4, the results from the case study performed are presented, as well as their implications. Lastly, Section 5 outlines the major insights drawn and directions for future research.

2. Hypotheses and Model Development

In this section, the theoretical foundation of the hypothesized model, as shown in Figure 1, is discussed in detail. Note that other than the typical TAM constructs, perceived visual attractiveness is emphasized to also have an effect on the entirety of academic web

portal adoption. Such an extension to the typical TAM serves as the main contribution of this study to the domain of technology adoption.

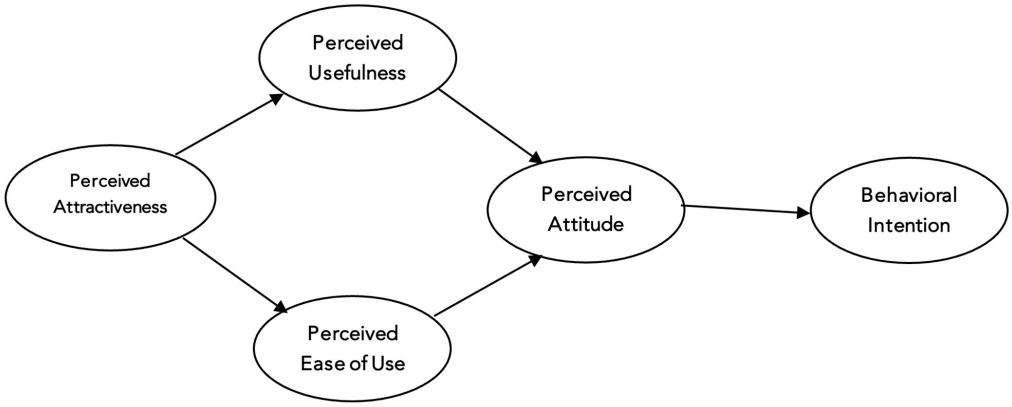

Figure 1. Hypothesized relations among constructs with respect to the adoption of academic web portals.

The specific relation of each construct is discussed as follows:

Perceived visual attractiveness, also referred to simply as perceived attractiveness, incorporates user interface details such as graphic style, design, appearance, and aesthetics among others, which essentially reflect the look and feel of a website [41]. It also considers the richness and quality of a website as well as the proper use of graphics, color, images, webpage size, and animations, to name a few [42]. Such attributes form part of an important aspect representing an affective and more intuitive response to a website. Moreover, perceived visual attractiveness of a website is considered to be under the larger scope of 'quality website', together with other major dimensions on data information [43] stability [44], privacy [45], and reliability, ease of use and website design [46], enjoyment and emotional attraction [44], and quality of services [47]. As these aspects are sufficiently achieved, a website tends to become well-designed, which results in better recall of users as well as a recognized favorable attitude toward the site [48]. In other contexts, such as social media, usage intentions specifically on technological aspects and user acceptance are further explained by the concept of attractiveness as a potential theoretical extension for its determinant models [49]. Furthermore, perceived visual attractiveness has been found to have a significant relationship, either being influenced or influencing, with other constructs used in the context of technology adoption in general, or in website evaluation, specifically [41,49]. Most notably, perceived visual attractiveness appears to influence both perceived usefulness and perceived ease of use. Note that aside from behavior intention, both perceived usefulness and perceived ease of use are parts of the original TAM framework developed by [14] to describe technology adoption in concrete areas. Specifically, perceived usefulness refers to the extent to which a user believes that using a system will enhance job performance, while perceived ease of use refers to the belief of users that the use of a system is effortless.

When the emotions of users are evoked through an impression of a website, a direct position of the impact on the initial perception, in addition to later perceptions of not only usability but also satisfaction, become apparent [50]. In fact, perceived visual attractiveness has also proven to be significant, while perceived usefulness plays a prevalent predictor of the intention of use. In another case, perceived visual attractiveness is also found to have a significant impact on the perceived usefulness of a website, considering that users tend to decide whether to browse a website longer depending on how attractive they find it. Moreover, users' perceived usefulness increases when an attractive layout and visual design are highly emphasized on a website. In terms of effectiveness, attractive user interfaces, as in mobile phones, appear to outperform unattractive ones, but may only be a mediating factor to perceived usability due to the inability of user interfaces to affect efficiency [51]. Moreover, it is believed that poor usability experiences may be overcome by the overall

favorable aesthetic impression of a website [52]. Thus, based on these relationships found in the literature, this study hypothesized the following on perceived visual attractiveness and perceived usefulness, and perceived ease of use:

Hypothesis 1. *Perceived visual attractiveness significantly influences perceived usefulness in the use of an academic web portal.*

Hypothesis 2. *Perceived visual attractiveness significantly influences perceived ease of use in the use of an academic web portal.*

Perceived usefulness and perceived ease of use are parts of the core constructs in the original TAM framework developed by [14]. These together highlight the significant influence it imposes on the attitude and intention of using technology, for instance, a website. It has been previously verified by numerous research studies in the literature that when a website is relatively easy to use, understand, and helpful, a positive influence on the user's attitudes can be evoked. With a higher level of perceived usefulness, the associated intention to adopt a technology becomes apparent; thus, usefulness is increased, as evidenced in the context of e-government adoption [53]. As a result, users are more willing to adopt such a technology, especially when they find that the services launched on the website enforce both the effectiveness and efficiency of doing various online transactions. In fact, perceived usefulness and perceived ease of use are found to be one of the main predictors of government website adoption [14,54]. Similarly, in other contexts such as online retailing, websites are used continuously by consumers when they realize their usefulness; thus, consumers tend to gather more product information from a specific retailer [55]. Furthermore, perceived ease of use for particular applications can enhance consumers' shopping experiences by providing cues on the attributes of products [55]. An enhanced experience then develops into a positive attitude towards online shopping websites.

In the specific context of the academic domain, both perceived usefulness and perceived ease of use also have a significant influence toward attitude that is consistent with many information system technologies previously studied. Some empirical evidence has also been found with respect to the relation of perceived usefulness and perceived ease of use as key factors for adopting an educational platform (i.e., Moodle) [56]. When lectures are made available anywhere, anytime—representing ease of use and convenience—students are more likely to engage with them [57]. Furthermore, students develop positive feelings about the perceived usefulness towards educational ICT tools as they aid in the productivity in student workload, acquisition of knowledge, and attainment of better grades [58]. Based on these relationships, the following hypotheses are framed in this study:

Hypothesis 3. *Perceived usefulness significantly influences attitude towards use of an academic web portal***.**

Hypothesis 4. *Perceived ease of use significantly influences attitude towards use of an academic web portal.*

Attitude towards the use of technology, or an academic web portal as in the case of this research, is widely believed to have a positive influence on the intention of users, as tested in several research studies focusing on acceptance of technology [56,59]. In fact, attitude towards use is found to have the most direct impact on the acceptance of a technology aiding in educational activities [60]. When students feel a positive attitude towards a technology (e.g., online lecture, tablet, web portal), the intention to use the platform increases correspondingly [61,62]. Recognizing that attitude, as a psychological concept, is composed of affect, cognition, and behavior, ample evidence has been found to support the significant role played by attitude towards persuading students' intentions to use a technology [61]. Given such relationships, this study proposes the following hypothesis:

Hypothesis 5. *Attitude towards use significantly influences behavioral intentions in the use of an academic web portal.*

3. Procedure

This section describes how the study was carried out, along with the subjects involved, the test environment, and the measures considered. Furthermore, the scales' validity and the questionnaire's overall reliability were investigated.

3.1. Research Design

In this research, data were obtained using a self-administered questionnaire via the face-to-face medium at the state university in the Philippines, from January to March 2019. Since all students in the state university are exposed to the use of the academic university portal to perform a variety of academic and administrative functions, a random pool of voluntary participants was invited to fill out the questionnaire. A total of 480 participants were asked to fill out the questionnaire in a pen-and-paper format. After completing the questionnaires, they were returned to the authors to be recorded and analyzed further according to the extended TAM framework. No incentive or any similar sort was given to the participants, in the same way that there were no penalties imposed on participants who declined to answer the questionnaire. Out of the 480 responses, only 418 could be used, which represented an 87% response rate. The remaining 62 responses were considered invalid, due to errors in multiple portions of the questionnaire, for instance, when a participant provided more than one selection of choice when a question only required one. Another type of invalid response was reflected when participants skipped a few sections of the questionnaire, hence, submitting an incomplete response form.

The sample size considered in this study was confirmed to be sufficient, using WarpPLS 7.0 statistical software under two techniques: (1) gamma-exponential and (2) inverse square root [63,64]. The path with the lowest and significant value in the structural model ($B = 0.12$) was used to estimate the sample size through these two techniques, with a level of significance equal to 0.05, and a power level of 0.78 from the recommended range of 0.50 to 0.99 [65]. Based on the dataset obtained, the gamma-exponential approach required a sample size of $N = 393$, while the inverse square root technique required a sample size of $N = 406$. Given these findings, the sample size of $N = 418$ utilized in the study was sufficient to accept the structural model's effects.

The demographics of the participants, in terms of gender, age group, and year level, are presented in Table 1. It can be seen that the numbers of male and female participants were close, at 51% and 49%, respectively. As for the age range, 58.1% were in the age group of 16–20 years old, 33% were in the age group 21–25 years old, and 8.9% were in the age group of 26 years old and above. Finally, the participants were composed mostly of first-year students (41.4%), third-year students (35.2%), second-year students (21.1%), and fourth-year students (2.4%). The distribution of participants was made in random order, as every student in the university is expected to have used the academic web portal at least once during their entire collegiate stay.

Table 1. Profile of the respondents.

Characteristics	Category	Frequency	Percentage
Gender	Male	213	51.0
	Female	205	49.0
Age Range	16–20 years old	243	58.1
	21–25	138	33.0
	26 and above	37	8.9
Year Level	First year	173	41.4
	Second year	88	21.1
	Third year	147	35.2
	Fourth year	10	2.4

3.2. Measures

The constructs used in this paper were composed of perceived visual attractiveness, perceived usefulness, perceived ease of use, attitude towards use, and behavioral intention, with a total of 22 items under investigation. The questionnaire development is presented In Table 2, which indicates the sources of items used in each construct. A 5-point Likert scale was used to record responses to these measuring questions, with 1 representing strong disagreement and 5 representing strong agreement, reflecting the degree of agreement with the collection of items.

Table 2. Constructs, items, and sources for the research instrument.

Construct	Item	Reference
Perceived Attractiveness	Overall I find that the CCS/WebApp looks attractive.	[14,32]
	The layout of the CCS/WebApp is attractive.	[2,14,32]
	The colors that are used on the CCS/WebApp are attractive.	[2,14,32]
Perceived Usefulness	Using CCS/WebApp enables me to accomplish a task more quickly.	[14,32]
	Using CCS/WebApp improves my performance.	[32]
	Using CCS/WebApp increases my productivity.	[32]
	Using CCS/WebApp enhances my effectiveness.	[32]
	Using CCS/WebApp makes my task easier.	[32]
	I would find CCS/WebApp useful.	[32]
Perceived Ease of Use	Learning to use CCS/WebApp is easy.	[32]
	I find it easy to use CCS/WebApp to do what I want to do.	[32]
	My interaction with CCS/WebApp is clear and understandable.	[14]
	I find CCS/WebApp to be flexible to interact with.	[14]
	It is easy for me to become skillful at using CCS/WebApp.	[14]
	I find CCS/WebApp easy to use.	[14]
Attitude Towards Use	I think that using CCS/WebApp is a good idea.	[14]
	I think that using CCS/WebApp is a wise idea.	[14]
	I think that using CCS/WebApp is a positive idea.	[14]
	I like the idea of using CCS/WebApp.	[14]
Behavioral Intention	I intend to continue to use CCS/WebApp in the future.	[14]
	I expect that I will use CCS/WebApp in the future.	[14]
	I plan to use CCS/WebApp in the future.	[14]

3.3. Construct Validity and Reliability

A causal-predictive research design was employed to measure hypothesized relationships among the constructs of the study [66]. To estimate the parameters of the study's framework, a combined partial least squares and path modeling (PLS-PM) method was executed under WarpPLS 7.0. Both the measurement model (i.e., construct validity and reliability) and the structural model (i.e., evaluation of collinearity, path coefficients, coefficient of determination, predictive relevance, and effect sizes) were evaluated [67].

Two tests were performed to evaluate the measurement model introduced in this research: reliability and validity. These tests were deemed necessary to ensure the following: (a) measurement errors were kept at acceptably low levels; (b) participants understood the question statements in the same way that other participants did, according to how the questionnaire was designed; and c) all latent variables measured distinct constructs [68]. A measurement model is considered to have acceptable convergent validity if the *p*-values associated with the loadings are equal to or lower than 0.05, and the standardized loading estimates are equal to or greater than 0.5 or ideally 0.7 or higher [65].

Table 3 shows that except for PU6, all indicators were loaded highly on their respective construct, with at least a 0.778 index. Furthermore, composite reliability (CR) and Cronbach's alpha values for all dimensions (i.e., attractiveness, perceived usefulness, perceived

ease of use, attitude, and behavioral intention) were significantly more than 0.70. Such results confirmed that the reliability of data was acceptable [65,69].

Table 3. Indicator loadings, convergent validity, and reliability test results.

Construct	Indicator Loading	Average Variance Extracted (AVE)	Composite Reliability	Cronbach's Alpha
Perceived Attractiveness	-	0.816	0.930	0.887
PA1	0.895			
PA2	0.937	-	-	-
PA3	0.876			
Perceived Usefulness	-	0.677	0.926	0.902
PU1	0.820			
PU2	0.850			
PU3	0.868	-	-	-
PU4	0.881			
PU5	0.837			
PU6	0.661			
Perceived Ease of Use	-	0.693	0.931	0.911
PEOU1	0.839			
PEOU2	0.853			
PEOU3	0.829	-	-	-
PEOU4	0.848			
PEOU5	0.778			
PEOU6	0.844			
Attitude	-	0.825	0.950	0.929
ATU1	0.911			
ATU2	0.913	-	-	-
ATU3	0.918			
ATU4	0.891			
Behavioral Intention	-	0.855	0.946	0.915
BI1	0.914			
BI2	0.939	-	-	-
BI3	0.921			

Note: Indicator loadings are significant at 0.001 ($p < 0.001$).

Moreover, the discriminant validity of the constructs was examined following the Fornell–Larcker criterion [65,70]. Table 4 shows that each construct had values greater than any values to their left in the same row, demonstrating that each construct was distinct from one another [65,70]. For example, attitude had a Fornell–Larcker criterion of average variance extracted (AVE) of 0.908; such a value was higher than the values to its left, being 0.706 for perceived ease of use, 0.534 for perceived usefulness, and 0.478 for attractiveness. When one construct such as attractiveness demonstrated distinctness from other constructs, this implied that such a construct was independent and unrelated to other constructs. Consequently, the heterotrait-monotrait (HTMT) ratio of correlations criteria was used to validate the discriminant validity of the latent variables (see Table 5). Recall that an HTMT ratio below 0.90 reflects that the discriminant validity has been objectively established among constructs [71]. Additionally, utilizing the 90% confidence intervals for HTMT inference, the value of 1 was not included within the confidence interval for all constructs, demonstrating discriminant validity [71–73]. With a specific reference to Table 5, notice that all constructs' discriminants were validated with an HTMT ratio below 0.90. For instance, perceived usefulness and attractiveness had an HTMT ratio of 0.747, suggesting that there exists a correlation between constructs. The same interpretation can be made for other constructs such as perceived ease of use and attractiveness, attitude and attractiveness, and behavioral intention and attractiveness, to name a few.

Table 4. Discriminant validity using the Fornell–Larcker criterion.

Constructs	Attractiveness	Perceived Usefulness	Perceived Ease of Use	Attitude	Behavioral Intention
Attractiveness	(0.903)				
Perceived Usefulness	0.667	(0.823)			
Perceived Ease of Use	0.560	0.659	(0.832)		
Attitude	0.478	0.534	0.706	(0.908)	
Behavioral Intention	0.495	0.555	0.638	0.681	(0.925)

Note: PA—diagonal values are the square root of AVE.

Table 5. Discriminant validity using the HTMT ratio of correlations.

Constructs	Attractiveness	Perceived Usefulness	Perceived Ease of Use	Attitude	Behavioral Intention
Attractiveness					
Perceived Usefulness	0.747 (0.670, 0.825)				
Perceived Ease of Use	0.626 (0.549, 0.703)	0.739 (0.661, 0.817)			
Attitude	0.527 (0.452, 0.603)	0.597 (0.521, 0.674)	0.767 (0.689, 0.845)		
Behavioral Intention	0.550 (0.474, 0.626)	0.620 (0.543, 0.696)	0.699 (0.622, 0.777)	0.739 (0.661, 0.816)	

Note: PA—diagonal values are the square root of AVE.

As a whole, the test for discriminant validity using two criteria, the Fornell–Larcker criterion and the HTMT ratio, showed that the hypothesized relations among constructs in the adoption of academic web portals were valid. It is worthy to emphasize that attractiveness, being the novel construct introduced to the traditional framework of academic web portal adoption, displayed a significant relation to perceived usefulness and perceived ease of use, as seen in the test for discriminant validity using two criteria.

4. Analysis and Results

Assessing the structural model involved five steps: (i) addressing the problem of collinearity, (ii) determining the path coefficients, (iii) determining the coefficient of determination, (iv) determining the impact magnitude using the effect size, and (v) determining the predictive relevance. To begin, the issue of collinearity was evaluated using the variance inflation factor (VIF). Vertical and lateral collinearity issues were inferred to be absent if the VIF values for each latent variable were less than the cut-off value of 5 [74–76]. As shown in Table 6, all constructions had VIF values between 1.922 and 2.690, indicating the absence of collinearity.

Table 6. Coefficient of determination, full collinearity VIF, Q^2.

Construct	R^2	Full Collinearity VIF	Q^2
Perceived Attractiveness	-	1.922	-
Perceived Usefulness	0.46	2.342	0.459
Perceived Ease of Use	0.32	2.690	0.313
Attitude	0.51	2.435	0.506
Behavioral Intention	0.47	2.154	0.466

Note: R^2—coefficient of determination, Q^2—Stone–Geisser's value.

Secondly, the results summarized in Table 5 indicate that perceived usefulness, H1 ($\beta = 0.68,\ p = 0.01$), and perceived ease of use, H2 ($\beta = 0.56,\ p = 0.01$), were both significantly influenced by perceived attractiveness. On the other hand, both perceived usefulness, H3 ($\beta = 0.12,\ p = 0.01$), and perceived ease of use, H4 ($\beta = 0.63,\ p = 0.01$), had a positive and significant effect on perceived attitude. Similarly, behavioral intention had a positive and statistically significant effect on attitude, H5: ($\beta = 0.68,\ p = 0.01$). Thus, all of the model's hypothesized relationships were validated, as seen in Figure 1. Thirdly, the coefficient of determination R^2 revealed that perceived attractiveness accounted for around 46%

of the variance in perceived usefulness, but for only 32% of the variance in perceived ease of use (see Table 6). Additionally, perceived usefulness and perceived ease of use accounted for approximately 51% of the difference in attitude. Additionally, 47% of the variation in behavioral intention was due to a change in Attitude.

Fourthly, the [77] guideline was used to determine the effect size f^2, with values of 0.02, 0.15, and 0.35 indicating a small, medium, and large effect size, respectively. To be more specific, the findings revealed that perceived attitude had a significant impact in explaining the R^2 of perceived usefulness $\left(f^2 = 0.458\right)$, while having a medium effect size in explaining the R^2 of perceived ease of use $\left(f^2 = 0.315\right)$. Perceived usefulness $\left(f^2 = 0.064\right)$ and perceived ase of Uuse $\left(f^2 = 0.443\right)$ were found to have medium and large effect sizes, respectively, in the process of calculating the R^2 of attitude. Another finding was that when calculating the R^2 of behavioral intention, the effect size of attitude was shown to be large $\left(f^2 = 0.468\right)$.

Finally, the model was further fitted using six global fit indices [78], and Stone–Geisser's Q^2 values, which indicate the model's explanatory power and predictive validity [79]. Results of the analysis suggest acceptable model–data fit, as demonstrated in the following indices: average path coefficient $(APC) = 0.534$, $p < 0.001$; average R-squared $(ARS) = 0.437$, $p < 0.001$; average adjusted R-squared $(AARS) = 0.436$, $p < 0.001$; average block VIF $(AVIF) = 1.771$, acceptable if <= 5, ideally <= 3.3; average full collinearity VIF $(AFVIF) = 2.309$, acceptable if <= 5, ideally <= 3.3; Tenenhaus GoF $(GoF) = 0.581$, small >= 0.1, medium >= 0.25, large >= 0.36. Moreover, the Stone–Geisser's Q^2 values for perceived usefulness, perceived ease of use, attitude, and behavioral intention were 0.459, 0.313, 0.506, and 0.466, respectively (see Table 7). Since all of the Q^2 values were larger than zero, the model's predictive relevance was acceptable [65].

Table 7. Results of hypothesis testing.

Hypothesis	Path	β	*p*-Value	f^2
H1	PA → PU	0.68	<0.01	0.458
H2	PA → PEOU	0.56	<0.01	0.315
H3	PU → ATT	0.12	<0.01	0.064
H4	PEOU → ATT	0.63	<0.01	0.443
H5	ATT → BI	0.68	<0.01	0.468

Note: PA—perceived attractiveness; PU—perceived usefulness; PEOU—perceived ease of use; ATT—attitude; BI—behavioral intention. Effect size (f2) was assessed using the following criteria: 0.02 = small, 0.15 = medium, 0.35 = large. β—standardized path coefficient.

5. Key Implications of the Results Generated

This section puts forward the key findings obtained from the hypothesized model proposed in the paper's theoretical framework.

Academic web portals have served a crucial role in the management and dissemination of information among the stakeholders in academe. Their availability and accessibility should be carefully taken into account such that a favorable adoption experience may be observed by students, being one of their major users. In a developing country, where resources are considered to be limited, it is very necessary for key stakeholders in any institution, with particular emphasis on state universities, to advocate wise allocation of funds for the development of academic web portals.

In the Philippines, where this study was conducted, interesting results was obtained from the model analyses. Primarily, the results indicate that perceived attractiveness has a significant role in the overall adoption of academic web portals in a state university. While previous research studies involving the TAM were enclosed within the typical constructs in perceived usefulness, perceived ease of use, perceived attitude, and behavioral intention, this study proved that extending the TAM, with the inclusion of perceived attractiveness, provides an even broader view of the adoption model in the context of academic web portals. In short, it is imperative to also look into the construct of perceived attractiveness in dealing

with adoption models, as it has also demonstrated its worth in other areas for the TAM such as green banking services [80], interactive video learning [81], mobile-based parenting resources [82], and social games [53], among others. In fact, the first two hypotheses relating to perceived attractiveness were verified, and can be further explored as follows.

First, a significant relationship between perceived attractiveness and perceived usefulness in the use of an academic web portal was noted, in the same way that perceived attractiveness was seen to have a significant influence on perceived ease of use. While previous research hinged more on both constructs—perceived usefulness and perceived ease of use—as major influencers of perceived attitude [54,79–84], this research showed that another construct—perceived attractiveness—significantly drives the realization of the two previous constructs into the overall adoption decision. Such a result clearly implies that the perceived attractiveness of an academic web portal matters to students. When students find that the academic web portal is affective, a more intuitive response to the platform can be derived [48]. Additionally, it has been found that perceived attractiveness has a significant impact on perceived usefulness in such a way that users lean toward browsing a website longer when it appears to be attractive enough for them.

Second, both perceived usefulness and perceived ease of use were found to have a significant influence on the attitude towards the use of academic web portals. Both constructs also showed the same significant relationship in prior studies concerning website adoption [14]. As users experience the effectiveness and efficiency of carrying out various transactions on a website, the willingness to adopt such technology becomes more apparent. Furthermore, users are inclined to gather more information from a website that is useful and relatively easy to use.

Finally, the attitude towards use also had a significant influence on behavioral intentions among students. Evidently, this study revealed that such points are highly consistent with previous research that specified that the intention to use a platform increases correspondingly with positive attitudes towards a technology experienced by users [61,62]. In another case that considered online purchasing, the intention to purchase food products online among shoppers in Brazil was positively influenced by attitude.

As a whole, the construct of perceived attractiveness, being a significant element in the adoption of academic web portals among students, should be dealt with by stakeholders with utmost importance and attention. Considering that perceived attractiveness drives perceived ease of use and perceived usefulness of an academic web portal, which in turn, influences perceived attitude and behavioral intentions, efforts in developing this construct should become the central focus of stakeholders. That is, by improving the perceived attractiveness of an academic web portal, all other constructs involved can be further indirectly improved as well. As an example, the user interface, including graphic style, design, appearance, and aesthetics, should be carefully curated to fit the liking of students. When such attributes are properly designed, affective and more intuitive responses to the academic web portal may become evident. The results closely and expectedly mimic cognitive load theory, which prompts human perception and cognition during information searches [84]. It has been contended that users increase their understanding, especially in the search process for information and other stimuli; thus, when the complexity of visual information increases, cognitive load also increases due to the increased demands on the processing resources not only on the perceptual aspect but also the cognitive aspect. In fact, in a cluttered visual design with excess items or misrepresented or disorganized data, degradation of performance at some tasks may occur [85]. Therefore, the complexity of a visual web page, not to mention the perceived visual attractiveness, should be rendered as an implicit measure of cognitive load that is expected for a user to process and interact with the web page.

The major findings of this study point to the significance of perceived attractiveness in the adoption of academic web portals, further reflecting opportunities for stakeholders to wisely allocate their resources into improvements that can bring about a significant impact on the overall system. Note that the Philippines is a developing country; such

status speaks about the limitations in resources that can be capped by the government to certain programs in education, for instance. Therefore, having particularly determined that perceived attractiveness is a major construct in academic web portal adoption directs the use of resources into the development of such a construct.

From a more general perspective, these major insights generated from exploring the hypothesized relations among factors involved in adopting academic web portals revealed that the proposed framework (see Figure 1) is valid and acceptable. Its validity and relevance translate into the necessity to incorporate the proposed construct—perceived visual attractiveness—into the overall decision-making analysis. Furthermore, the hypotheses developed also proved that both perceived usefulness and perceived ease of use are correlated with perceived visual attractiveness. Thus, stakeholders in academic institutions should recognize the need to pay careful attention to not only these two usual constructs (i.e., perceived usefulness and perceived ease of use), but also to perceived visual attractiveness, being the distinct and significant construct as it is.

6. Conclusions

This paper proposed a new framework for the technology adoption model (TAM) in the academic domain, which incorporates perceived visual attractiveness as an influencing construct to both perceived usefulness and perceived ease of use. Traditionally, TAM frameworks only include perceived usefulness and perceived ease of use as influencing constructs to perceived attitude, thereby, influencing the behavioral intention of users. However, the traditional framework appeared to be rather inconclusive of the contextual relationships among perceived visual attractiveness and perceived usefulness and perceived ease of use. True enough, with the use of structural equation modelling, this research showed that the inclusion of perceived visual attractiveness is a significant and distinct portion of the overall decision-making analysis.

An important stance generated from the results of this paper is for stakeholders in academic institutions to mainly ensure that the academic web portals developed are attractive to students. That is, attributes in the overall quality of the website, such as data information, stability, privacy, reliability, ease of use and website design, enjoyment and emotional attraction, and quality of services, should be closely considered. By significantly improving the perceived attractiveness of academic web portals, other constructs that also play a crucial role in their eventual adoption can also be potentially enhanced, as observed in the relationships extracted in this study. As such, not only is the major construct fully attended, but the wise allocation of resources is also set.

While the integration of perceived attractiveness into the TAM framework, specifically in typical academic web portals, has already been carried out, the results in this study resonate particularly in the context of academe. In other words, it can be safe to conclude that users in academe, especially students, are more particular with how academic web portals appeal to their liking. Therefore, academic web portal developers should consider the interests of students in terms of perceived attractiveness. A more detailed outline of attributes that users find most attractive should also be developed.

In future research, the limitations of this study can be addressed. For one, while research subjects involved in this study mainly involved students, the selection can be further expanded to other users, including faculty members and administrative staff, who also use academic web portals as a support tool in delivering their services. By covering all possible users of academic web portals as subjects, such can be designed in ways that satisfy all users. For another, additional constructs in the TAM framework, such as trust, can also be integrated into the analyses to explore their probable effects on the overall framework. Moreover, since this study solely focused on integrating perceived visual attractiveness to the traditional TAM framework, other avenues to further assess the acceptance of technology can be looked into, such as incorporating the competing models of UTAUT, U&GT, and TPACK, to name a few. By collecting the factors considered in each framework and altogether assessing technology adoption through these lenses, a more

holistic and comprehensive view can be achieved. Lastly, the limitations of the research design in this study can also be advanced by considering the collective perspective of educators, as well as administrators and students. Furthermore, other than undergraduate students, graduate students may also be invited to participate in the collection of data. When such a collective perspective is generated, more refined results with respect to the eventual adoption of technology can be achieved.

Other methodological advancements can also be considered to further assess the relationship among constructs in the adoption of academic web portals. Such methodologies may include, but are not limited to, decision-making trials and evaluation laboratories (DEMATEL) to distinguish the characteristics of constructs being either under the cause or effect category. For another, an analytical network process (ANP) may also be utilized to explore the weighted priorities of each construct.

Author Contributions: Conceptualization, J.M.S.G.II, M.M.H. and C.M.H.; Writing—original draft, J.M.S.G.II; Supervision, M.M.H., C.M.H., L.A.O.; Project administration, M.M.H., G.R.R.D., M.J.B.A., N.P.B. and L.A.O.; Funding acquisition, C.M.H.; Data curation, G.R.R.D.; Formal analysis, M.J.B.A.; Investigation, N.P.B.; Writing—review & editing, M.F.B. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding. The authors contributed for the APC.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are in-text.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Tatnall, A. In Real-Life Learning, What is Meant by 'Real'? In *Information and Communication Technologies and Real-Life Learning*; van Weert, T., Tatnall, A., Eds.; IFIP—The International Federation for Information Processing; Springer: Boston, MA, USA, 2005; Volume 182. [CrossRef]
2. Bahry, F.D.S.; Anwar, N.; Amran, N. Predicting intended to use of web portal using extended technology acceptance model (TAM): Some perspective on information management students. In Proceedings of the 2012 IEEE Symposium on Business, Engineering and Industrial Applications, Bandung, Indonesia, 23–26 September 2012; IEEE: Piscataway, NJ, USA, 2012. [CrossRef]
3. Apter, A.J.; Bryant-Stephens, T.; Perez, L.; Morales, K.H.; Howell, J.T.; Mullen, A.N.; Han, X.; Canales, M.; Rogers, M.; Klusaritz, H.; et al. Patient Portal Usage and Outcomes Among Adult Patients with Uncontrolled Asthma. *J. Allergy Clin. Immunol. Pract.* **2019**, *8*, 965–970.e4. [CrossRef]
4. Urbach, N.; Smolnik, S.; Riempp, G. An empirical investigation of employee portal success. *J. Strat. Inf. Syst.* **2010**, *19*, 184–206. [CrossRef]
5. De Juana-Espinosa, S.; Luján-Mora, S. Open government data portals in the European Union: Considerations, development, and expectations. *Technol. Forecast. Soc. Chang.* **2019**, *149*, 119769. [CrossRef]
6. Kalaimani, J. Chapter 11: Leveraging SAP enterprise portal. In *SAP Project Management Pitfalls*; Apress: New York, NY, USA, 2016. [CrossRef]
7. Chen, Y.H.; Chengalur-Smith, I. Factors influencing students' use of a library Web portal: Applying course-integrated infor-mation literacy instruction as an intervention. *Internet High Educ.* **2015**, *26*, 42–55. [CrossRef]
8. Barnes, S.; Vidgen, R. An integrative approach to the assessment of e-commerce quality. *J. Electron. Commer. Res.* **2002**, *3*, 114–127.
9. Bringula, R.P. Influence of faculty- and web portal design-related factors on web portal usability: A hierarchical regression analysis. *Comput. Educ.* **2013**, *68*, 187–198. [CrossRef]
10. Nambisan, P. Factors that impact Patient Web Portal Readiness (PWPR) among the underserved. *Int. J. Med. Inform.* **2017**, *102*, 62–70. [CrossRef]
11. Thomas-Alvarez, N.; Mahdjoubi, L. Testing the effectiveness of a web-based portal system for the building control sector. *Autom. Constr.* **2013**, *29*, 196–204. [CrossRef]
12. Garcia, F.; Grabot, B.; Paché, G. Adoption mechanisms of a supplier portal: A case study in the European aerospace industry. *Comput. Ind. Eng.* **2019**, *137*, 106105. [CrossRef]
13. Telang, R.; Mukhopadhyay, T. Drivers of Web portal use. *Electron. Commer. Res. Appl.* **2005**, *4*, 49–65. [CrossRef]
14. Davis, F.D. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Q.* **1989**, *13*, 319–340. [CrossRef]

15. Venkatesh, V.; Davis, F.D. A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies. *Manag. Sci.* **2000**, *46*, 186–204. [CrossRef]
16. Mishra, P.; Koehler, M.J. Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge. *Teach. Coll. Rec.* **2006**, *108*, 1017–1054. [CrossRef]
17. Katz, E.; Blumler, J.G.; Gurevitch, M. Uses and Gratifications Research. *Public Opin. Q.* **1973**, *37*, 509–523. [CrossRef]
18. Lometti, G.E.; Reeves, B.; Bybee, C.R. Investigating the Assumptions of Uses and Gratifications Research. *Commun. Res.* **1977**, *4*, 321–338. [CrossRef]
19. Kim, H.-W.; Chan, H.C.; Gupta, S. Value-based Adoption of Mobile Internet: An empirical investigation. *Decis. Support Syst.* **2007**, *43*, 111–126. [CrossRef]
20. Holden, R.J.; Karsh, B.-T. The Technology Acceptance Model: Its past and its future in health care. *J. Biomed. Inform.* **2010**, *43*, 159–172. [CrossRef]
21. Zeithaml, V.A. Consumer Perceptions of Price, Quality, and Value: A Means-End Model and Synthesis of Evidence. *J. Mark.* **1988**, *52*, 2–22. [CrossRef]
22. Charness, N.; Boot, W.R. Technology, gaming, and social networking. In *Handbook of the Psychology of Aging*, 8th ed.; Elsevier: Amsterdam, The Netherlands, 2016; pp. 389–407.
23. Zhou, M.; Zhao, L.; Kong, N.; Campy, K.S.; Qu, S.; Wang, S. Factors influencing behavior intentions to telehealth by Chinese elderly: An extended TAM model. *Int. J. Med. Inform.* **2019**, *126*, 118–127. [CrossRef]
24. Diop, E.B.; Zhao, S.; Van Duy, T. An extension of the technology acceptance model for understanding travelers' adoption of variable message signs. *PLoS ONE* **2019**, *14*, e0216007. [CrossRef]
25. Chi, T. Understanding Chinese consumer adoption of apparel mobile commerce: An extended TAM approach. *J. Retail. Consum. Serv.* **2018**, *44*, 274–284. [CrossRef]
26. Yoon, C. Extending the TAM for Green IT: A normative perspective. *Comput. Hum. Behav.* **2018**, *83*, 129–139. [CrossRef]
27. Fayad, R.; Paper, D. The Technology Acceptance Model E-Commerce Extension: A Conceptual Framework. *Procedia Econ. Finance* **2015**, *26*, 1000–1006. [CrossRef]
28. Kamal, S.A.; Shafiq, M.; Kakria, P. Investigating acceptance of telemedicine services through an extended technology ac-ceptance model (TAM). *Technol. Soc.* **2020**, *60*, 101212. [CrossRef]
29. Rafique, H.; Almagrabi, A.O.; Shamim, A.; Anwar, F.; Bashir, A.K. Investigating the Acceptance of Mobile Library Applications with an Extended Technology Acceptance Model (TAM). *Comput. Educ.* **2019**, *145*, 103732. [CrossRef]
30. Beldad, A.D.; Hegner, S.M. Expanding the technology acceptance model with the inclusion of trust, social influence, and health valuation to determine the predictors of German users' willingness to continue using a fitness app: A structural equation modeling approach. *Int. J. Hum. Comput. Interact.* **2018**, *34*, 882–893. [CrossRef]
31. Lee, J.-H.; Lee, C.-F. Extension of TAM by Perceived Interactivity to Understand Usage Behaviors on ACG Social Media Sites. *Sustainability* **2019**, *11*, 5723. [CrossRef]
32. Van der Heijden, H. Factors influencing the usage of websites: The case of a generic portal in The Netherlands. *Inf. Manag.* **2003**, *40*, 541–549. [CrossRef]
33. Alalwan, A.A.; Baabdullah, A.M.; Rana, N.P.; Tamilmani, K.; Dwivedi, Y.K. Examining adoption of mobile internet in Saudi Arabia: Extending TAM with perceived enjoyment, innovativeness and trust. *Technol. Soc.* **2018**, *55*, 100–110. [CrossRef]
34. Kim, Y.G.; Woo, E. Consumer acceptance of a quick response (QR) code for the food traceability system: Application of an extended technology acceptance model (TAM). *Food Res. Int.* **2016**, *85*, 266–272. [CrossRef]
35. Lai, P.C. Security as an Extension to TAM Model: Consumers' Intention to Use a Single Platform E-Payment. *Asia-Pac. J. Manag. Res. Innov.* **2017**, *13*, 110–119. [CrossRef]
36. Kumar, V.R.; Lall, A.; Mane, T. Extending the TAM Model: Intention of Management Students to Use Mobile Banking: Evidence from India. *Glob. Bus. Rev.* **2017**, *18*, 238–249. [CrossRef]
37. Bloch, P.H. Seeking the Ideal Form: Product Design and Consumer Response. *J. Mark.* **1995**, *59*, 16–29. [CrossRef]
38. Lavie, T.; Tractinsky, N. Assessing dimensions of perceived visual aesthetics of web sites. *Int. J. Hum.-Comput. Stud.* **2004**, *60*, 269–298. [CrossRef]
39. Sweller, J. Cognitive Load During Problem Solving: Effects on Learning. *Cogn. Sci.* **1988**, *12*, 257–285. [CrossRef]
40. Aditia, E.; Tela, I.N.; Saleh, N.; Ilona, D.; Zaitul, Z. Understanding the Behavioral Intention to Use a University Web-Portal. *MATEC Web Conf.* **2018**, *248*, 05004. [CrossRef]
41. Wu, C.H.-J.; Li, H.-J.; Chiu, C.-W. Understanding Consumer Responses to Travel Websites from Online Shopping Value and Flow Experience Perspectives. *Tour. Econ.* **2014**, *20*, 1087–1103. [CrossRef]
42. Skadberg, Y.X.; Kimmel, J.R. Visitors' flow experience while browsing a web site: Its measurement, contributing factors and consequences. *Comput. Hum. Behav.* **2004**, *20*, 403–422. [CrossRef]
43. Aladwani, A.M.; Palvia, P.C. Developing and validating an instrument for measuring user-perceived web quality. *Inf. Manag.* **2002**, *39*, 467–476. [CrossRef]
44. Liu, K.P.A.C.; Arnett, K.P.; Litecky, C. Design Quality of Websites for Electronic Commerce: Fortune 1000 Webmasters' Evaluations. *Electron. Mark.* **2000**, *10*, 120–129. [CrossRef]
45. Yoo, B.; Donthu, N. Developing and validating a multidimensional consumer-based brand equity scale. *J. Bus. Res.* **2001**, *52*, 1–14. [CrossRef]

46. Loiacono, E.T.; Watson, R.T.; Goodhue, D.L. WebQual: A measure of website quality. *Mark. Theory Appl.* **2002**, *13*, 432–438.
47. Wolfinbarger, M.; Gilly, M.C. eTailQ: Dimensionalizing, measuring and predicting etail quality. *J. Retail.* **2003**, *79*, 183–198. [CrossRef]
48. Boon-Itt, S. Quality of health websites and their influence on perceived usefulness, trust and intention to use: An analysis from Thailand. *J. Innov. Entrep.* **2019**, *8*, 4. [CrossRef]
49. Wirtz, B.W.; Piehler, R.; Ullrich, S. Determinants of social media website attractiveness. *J. Electron. Commer. Res.* **2013**, *14*, 11–33.
50. Lindgaard, G. Aesthetics, visual appeal, usability and user satisfaction: What do the user's eyes tell the user's brain? *Aust. J. Emerg. Technol. Soc.* **2007**, *5*, 1–14.
51. Quinn, J.M.; Tran, Q.T. Attractive phones don't have to work better: Independent effects of attractiveness, effectiveness, and efficiency on perceived usability. In Proceedings of the Conference on Computer Human Interaction, Atlanta, GA, USA, 10–15 April 2010.
52. Hartmann, J.; Sutcliffe, A.; De Angeli, A. Investigating attractiveness in web user interfaces. In Proceedings of the Conference on Computer Human Interaction, San Jose, CA, USA, 28 April–3 May 2007.
53. Alomari, M.; Woods, P.; Sandhu, K. Predictors for e-government adoption in Jordan. *Inf. Technol. People* **2012**, *25*, 207–234. [CrossRef]
54. Nguyen, T.T.H.; Nguyen, N.; Nguyen, T.B.L.; Phan, T.T.H.; Bui, L.P.; Moon, H.C. Investigating Consumer Attitude and Intention towards Online Food Purchasing in an Emerging Economy: An Extended TAM Approach. *Foods* **2019**, *8*, 576. [CrossRef]
55. Dennis, C.; Morgan, A.; Wright, L.T.; Jayawardhena, C. The influences of social e-shopping in enhancing young women's online shopping behavior. *J. Cust. Behav.* **2010**, *9*, 151–174. [CrossRef]
56. Masrom, M. Technology Acceptance Model and E-learning. In Proceedings of the 12th International Conference on Education, Brunei, Darussalam, 21–24 May 2007; pp. 1–10.
57. Khee, C.M.; Wei, G.W.; Jamaluddin, S.A. Students' Perception towards Lecture Capture based on the Technology Acceptance Model. *Procedia Soc. Behav. Sci.* **2014**, *123*, 461–469. [CrossRef]
58. Kwok, D.; Yang, S. Evaluating the intention to use ICT collaborative tools in a social constructivist environment. *Int. J. Educ. Technol. High. Educ.* **2017**, *14*, 32. [CrossRef]
59. Teo, T.; Lee, C.B.; Chai, C.S.; Wong, S.L. Assessing the intention to use technology among pre-service teachers in Singapore and Malaysia: A multigroup invariance analysis of the Technology Acceptance Model (TAM). *Comput. Educ.* **2009**, *53*, 1000–1009. [CrossRef]
60. El-gayar, O.; Moran, M.; Hawkes, M. Students' Acceptance of Tablet PCs and Implications for Educational Institutions. *Educ. Technol. Soc.* **2011**, *14*, 58–70.
61. Hussein, Z. Leading to Intention: The Role of Attitude in Relation to Technology Acceptance Model in E-Learning. *Procedia Comput. Sci.* **2017**, *105*, 159–164. [CrossRef]
62. Rupak, R.; Greg, R.; Jei, Y.; Ben, J. Technology acceptance model (TAM) and social media usage: An empirical study on Face-book. *J. Enterp. Inf. Manag.* **2014**, *27*, 6–30.
63. Kock, N.; Hadaya, P. Minimum sample size estimation in PLS–SEM: The inverse square root and gamma—Exponential methods. *Inf. Syst. J.* **2018**, *28*, 227–261. [CrossRef]
64. Hair, J.F.; Risher, J.J.; Sarstedt, M.; Ringle, C.M. When to use and how to report the results of PLS-SEM. *Eur. Bus. Rev.* **2019**, *31*, 2–24. [CrossRef]
65. Kock, N. *WarpPLS User Manual: Version 7.0*; ScriptWarp Systems: Laredo, TX, USA, 2020.
66. Hwang, H.; Ho, M.-H.R.; Lee, J. Generalized Structured Component Analysis with Latent Interactions. *Psychometrika* **2010**, *75*, 228–242. [CrossRef]
67. Hair, J.; Black, W.; Babin, B.; Anderson, R. *Multivariate Data Analysis*, 8th ed.; CENGAGE: Hampshire, UK, 2019.
68. Kock, N.; Mayfield, M.; Mayfield, J.; Sexton, S.; De La Garza, L.M. Empathetic Leadership: How Leader Emotional Support and Understanding Influences Follower Performance. *J. Leadersh. Organ. Stud.* **2018**, *26*, 217–236. [CrossRef]
69. Chin, W. How to write up and report PLS analyses. In *Handbook of Partial Least Squares: Concepts, Methods and Applications*; Vinzi, V., Chin, W., Henseler, J., Wang, H., Eds.; Springer: Berlin/Heidelberg, Germany, 2010; p. 655690.
70. Fornell, C.; Larcker, D.F. Evaluating structural equation models with unobservable variables and measurement error. *J. Mark. Res.* **1981**, *18*, 39–50. [CrossRef]
71. Henseler, J.; Ringle, C.M.; Sarstedt, M. A new criterion for assessing discriminant validity in variance-based structural equation modeling. *J. Acad. Mark. Sci.* **2015**, *43*, 115–135. [CrossRef]
72. Ab Hamid, M.; Sami, W.; Sidek, M.M. Discriminant validity assessment: Use of Fornell & Larcker criterion versus HTMT criterion. *J. Phys. Conf. Ser.* **2018**, *890*, 012163.
73. Franke, G.; Sarstedt, M. Heuristics versus statistics in discriminant validity testing: A comparison of four procedures. *Internet Res.* **2019**, *29*, 430–447. [CrossRef]
74. Hair, J.F.; Tatham, R.L.; Anderson, R.E. *Multivariate Data Analysis*, 5th ed.; Prentice Hall: Hoboken, NJ, USA, 1998.
75. Kline, R.B. *Principles and Practice of Structural Equation Modelling*; The Guilford Press: New York, NY, USA, 1998.
76. Cohen, J. *Statistical Power Analysis for the Behavioral Sciences*; Routledge Academic: New York, NY, USA, 1988.
77. Hair, J.F.; Ringle, C.M.; Sarstedt, M. PLS-SEM: Indeed a silver bullet. *J. Mark. Theory Pract.* **2011**, *19*, 139–151. [CrossRef]

78. Kock, N. Advanced Mediating Effects Tests, Multi-Group Analyses, and Measurement Model Assessments in PLS-Based SEM. *Int. J. e-Collab.* **2014**, *10*, 1–13. [CrossRef]
79. Iqbal, M.; Rifat, A.; Nisha, N. Evaluating attractiveness and perceived risks: The case of green banking services in Bangladesh. *Int. J. Asian Bus. Inf. Manag.* **2021**, *12*, 1–23. [CrossRef]
80. Su, C.-Y.; Chiu, C.-H. Perceived Enjoyment and Attractiveness Influence Taiwanese Elementary School Students' Intention to Use Interactive Video Learning. *Int. J. Hum.-Comput. Interact.* **2020**, *37*, 574–583. [CrossRef]
81. Kothari, A.; Godleski, S.; Abu, B.A.Z. Mobile-based consortium of parenting resources for low-income and underserved mothers and caregivers: App development, testing and lessons learned. *Health Technol.* **2020**, *10*, 1603–1608. [CrossRef]
82. Chang, C.-C.; Chen, P.-Y. Analysis of critical factors for social games based on extended technology acceptance model: A DEMATEL approach. *Behav. Inf. Technol.* **2018**, *37*, 774–785. [CrossRef]
83. Cheung, R.; Vogel, D. Predicting user acceptance of collaborative technologies: An extension of the technology acceptance model for e-learning. *Comput. Educ.* **2013**, *63*, 160–175. [CrossRef]
84. Gwizdka, J. Distribution of cognitive load in Web search. *J. Am. Soc. Inf. Sci. Technol.* **2010**, *61*, 2167–2187. [CrossRef]
85. Rosenholtz, R.; Li, Y.; Nakano, L. Measuring visual clutter. *J. Vis.* **2007**, *7*, 17–22. [CrossRef] [PubMed]